Space Weather Technical Forecast

Issued on Sunday, 07 November 2021 at 00:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of M-class flares. Chance of isolated G1/Minor geomagnetic storms on Days 1 and 2. Active electron fluence likely from Day 2.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: There are currently four active regions on the visible disc. AR2891 (Axx/Alpha) in the northwest is small and simple. AR2893 (Hsx/Alpha) near centre disk remains a single moderately sized unipolar spot. AR2894 (Hsx/Alpha) in the southeast quarter, with the small trailer spots re-classified as a new active region (Bxo/Beta). A further region of plage is crossing over the northeast horizon, and remains spotless at present. Two small C-Class and several B-Class flares were evident in the last 24 hours, mostly from AR2894 near the southeast limb. No significant Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by DSCOVR at L1 was mostly Elevated through the period with a spell of Strong solar winds at first peaking at 633 km/s at 06/0132 UTC, probably due to a glancing blow from a weak CME that left the Sun on 2 Nov. Density was slightly above average, peaking at 21ppcc at 06/0000 UTC, with a gradual decline to average values. Total IMF, Bt, started the period at Moderate levels, around 11nT, before soon declining to Weak. The north-south component, Bz, was mostly weak, fluctuating between +10/-5nT. Phi angle remained mainly negative (towards the Sun). Geomagnetic levels were Quiet to Unsettled with a couple of Active intervals.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels. The high energy electron flux (greater than 2 MeV) was at mostly moderate levels in the past 24 hours, before exceeding the high threshold from 06/1820 UTC. The associated 24-hour electron fluence was below the Active (1e8 integrated pfu) threshold and is currently on a rising trend, with 5.47e7 integrated pfu recorded at 06/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Low or Very Low with a continuing slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: Solar winds starting at Elevated levels may return to Strong levels for a time on Day 1 and early on Day 2 (7&8 Nov), before probably then easing back to Slightly Elevated levels on Days 3&4 (9&10 Nov.). Geomagnetic activity is likely to be Quiet to Unsettled with an increased chance of Active to G1/Minor Storm intervals on Day 1 (7 Nov.) and perhaps early on Day 2 (8 Nov.).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) is likely to reach high levels at times through the next 4 days, mainly during diurnal peaks.

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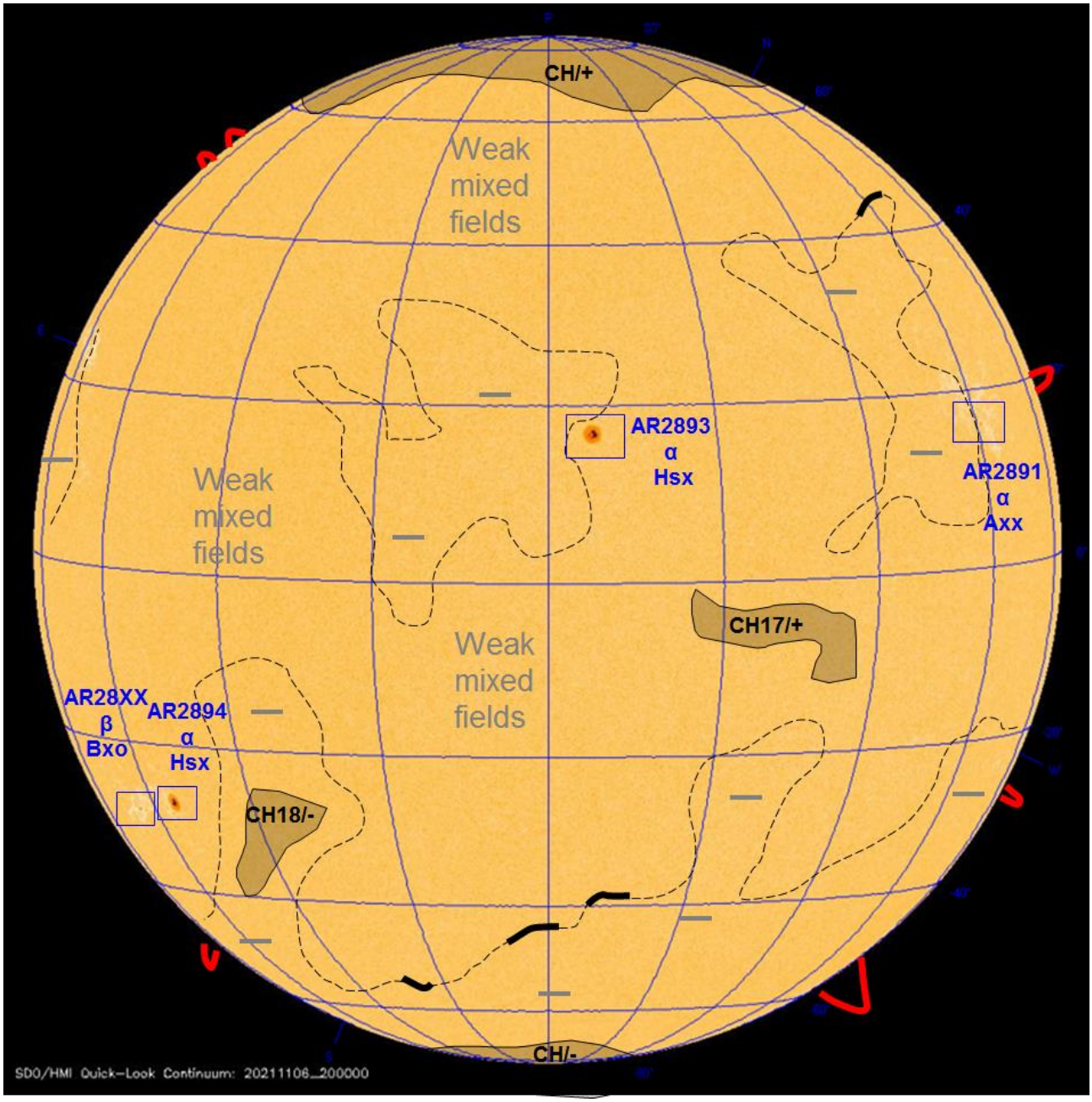
Corresponding 24 hour electron fluence values are currently below the Active (1e8 integrated pfu) threshold, but an overall increasing trend is likely through the period. The Active threshold will probably be breached during Day 2 (8 Nov.) with low confidence for the timing of this event.

Figure 1. Solar Analysis Valid 2000UTC, 6 November 2021.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Solar winds responded to the passage of a small glancing CME from 2nd November during the early hours of 6th Nov. No other Earth directed CMEs have been observed or are expected to be en-route at present.

The forward leading edge of Coronal hole (CH17/+) is close to 40 degrees west of centre disc, and just south of the solar equator. This feature looks a little different to last rotation (it's further advanced this time around). The most likely arrival time on this rotation is during Day 1 (7 Nov), with the solar wind returning to just above 600 km/s. STEREO-A appears to show signs of HSS influence however, solar winds currently affecting Earth are still being influenced from waning CME effects, so the HSS will probably prolong the elevated wind speeds.

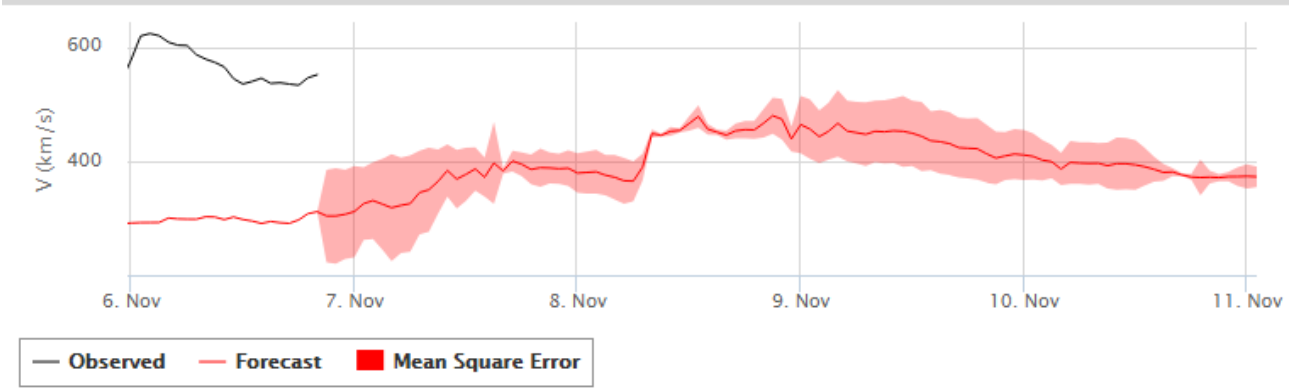
Quiet to Unsettled geomagnetic activity is expected through much of the period, but perhaps with the greatest chance for Active to G1/Minor Storm intervals on Day 1 and early on Day 2 (6 and 7 Nov.).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	30	10	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

Figure 2: Met Office Solar Winds Prediction Model, showing an elevated stream post CME arrival.



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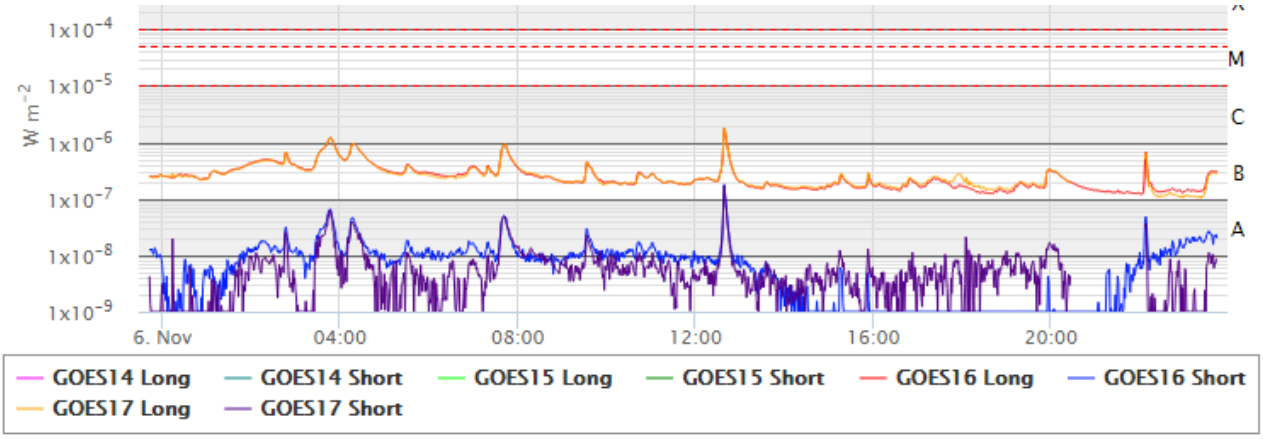
Radio Blackouts - X-Ray Flares:
There are currently four active regions on the visible disc, and these are currently becoming less complex with a trend for flares to be less frequent. Probabilities have been pegged back a little in light of the current evidence. Solar Activity from the numbered regions on the visible disc is expected to be at Low levels, with a slight chance (5-10%) of isolated M-class flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES X-ray flux showing minor B and C-class flares over the past 24 hours.



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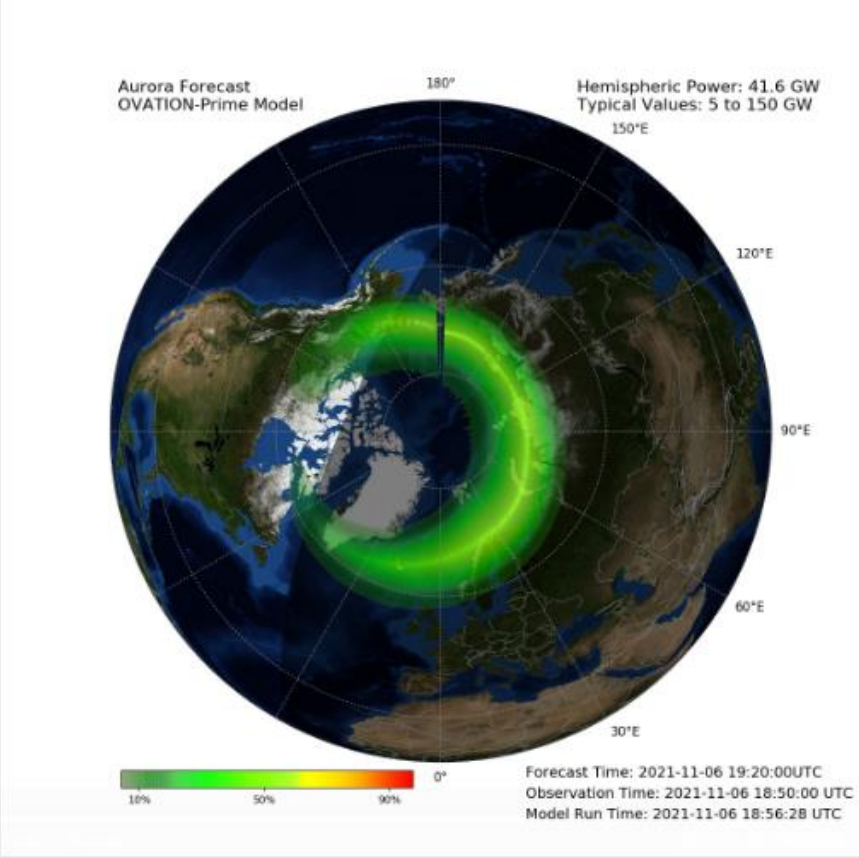
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is at background levels, with little change likely.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 4: Met Office Auroral Forecast indicating an increase in geomagnetic activity during Day 1 (7 Nov.).



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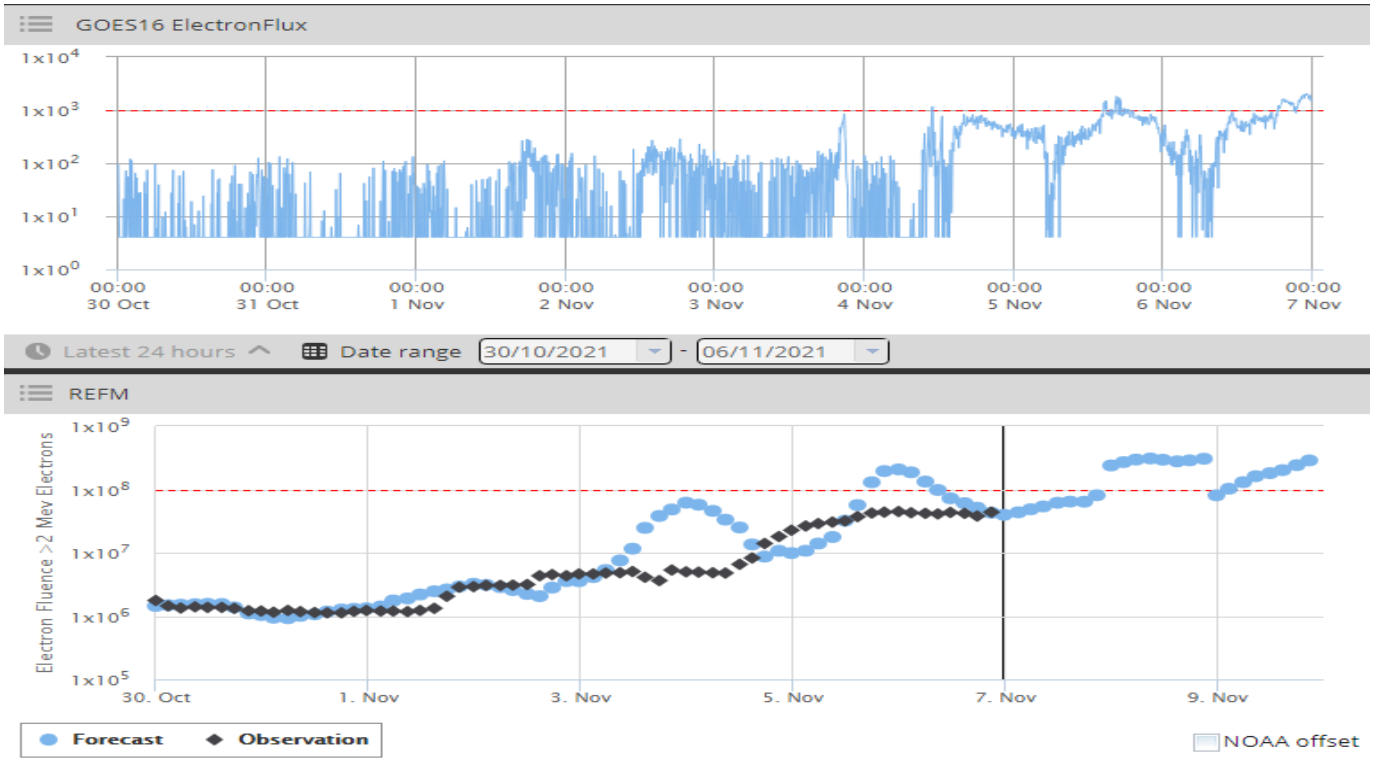
High Energy Electrons Event (≥ 2MeV):
During this current spell of Elevated to Strong solar winds and an anticipated connection with coronal hole 17/+ maintains an increased risk of exceeding the high threshold, more especially during diurnal peaks, perhaps with a slight rising trend through the period as the Van Allen belts recover.
Corresponding 24 hour electron fluence values are currently below the Active (1e8 integrated pfu) level, but with a rising trend. An overall increasing trend is likely through the period due to anticipated coronal hole influence, The Active threshold will probably be breached during Day 2 (8 Nov.) but confidence is low for the timing of this. The Met Office REFM output is considered to be giving reasonable guidance in the overall trend, but is currently over-estimating fluence levels, and may be over-forecasting these levels in the forecast period.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}\ sr^{-1}\ day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	60	70	80	80
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	10	10	10

Figure 5: Met Office High Energy Electron Flux and Met Office REFM output over the past week.



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